

31. Filariid Worms from Mammals and Birds in the Society's Gardens, 1914-1915. By C. L. BOULENGER, M.A., D.Sc., F.Z.S., Professor of Zoology, University of the Panjab, Lahore.

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In February 1914, I was asked by the Prosectorial Committee to undertake the identification of the Nematode parasites obtained at the Society's Gardens, and material was forwarded to me from the Prosectorium at regular intervals until the beginning of 1916. During this period monthly reports, containing provisional identifications, were sent to the Committee, the material being laid aside for further investigation. My study of the collection thus accumulated was interrupted by my departure for Mesopotamia on war service, and was only resumed three years later at the end of 1919.

The material described in the present memoir consists of the representatives of the Family Filariidæ obtained from Mammals and Birds in the Gardens. Altogether eight species were met with, two of which are described as new. Of the known forms, three have been previously observed on single occasions only and are species about which further information was desired; the other three are worms commonly reported from Zoological Gardens; yet even of these our knowledge is by no means complete, and I have therefore added a short account of two of them to my descriptions of the less known species.

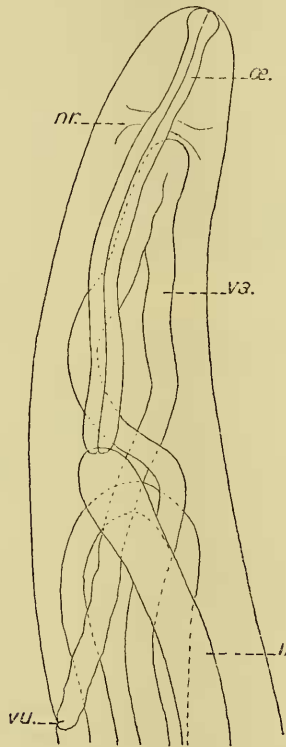
During recent years renewed attempts have been made by various authors, especially Railliet and Henry, to break up the old genus *Filaria* s.l., and have resulted in a much improved knowledge of many of the commoner Filariids; some of the older generic names proposed by Viborg, Diesing, etc., have been revived and several new genera established. In this paper, I have attempted, wherever possible, to refer the worms described to these new groupings.

Genus *FILARIA* Mueller, 1787.*FILARIA SUBCUTANEA* v. Linstow, 1899, non Parona, 1894.

A number of specimens of this species were obtained from the subcutaneous tissue of the Canadian Porcupine, *Erethizon dorsatum*.

This species, which is known only from the type-specimens obtained from the same host in the Berlin Zoological Gardens,

Text-figure 1.

*Filaria subcutanea* v. Linst.

Lateral view of the anterior extremity of female. $\times 38$.

i., intestine; n.r., nerve-ring; œ., oesophagus; va., vagina; vu., vulva.

is of special interest, for, as pointed out by Hall (1916), there is reason to believe that *F. subcutanea* v. Linst. is a synonym of *F. martis* Gmelin, the species generally regarded as the type-species of the genus *Filaria* s. str.

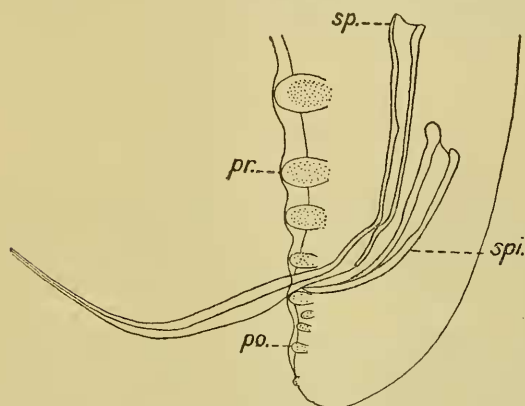
My account of *F. subcutanea* will be found to differ in some respects from that given by v. Linstow, yet I think there is little

doubt that we have both dealt with the same form. *F. martis* is very imperfectly known, and until new material is described the relationship between the two species must remain doubtful; there are certain characters, *e. g.*, the position of the vulva, which in our present state of knowledge it is impossible to reconcile.

Hall has pointed out that *v. Linstow's* specific name is a homonym of *F. subcutanea* Parona, 1894. I have followed his example and refrained from renaming the species until its proper relationship with *Filaria martis* is ascertained.

My material was obtained from the same animal as the microfilaria recorded by Plimmer (1915) in his annual report on the blood-parasites; Hall is therefore right in assuming that this larval stage is to be referred to *F. subcutanea v. Linst.*

Text-figure 2.



Filaria subcutanea v. Linst.

Posterior extremity of male, lateral view. $\times 225$.

po., postanal papilla; *pr.*, preanal papilla; *sp.*, short spicule; *spi.*, long spicule.

Specific diagnosis.—*Filaria*: Body filiform, more attenuated posteriorly than anteriorly, both extremities rounded.

Cuticle appears smooth except under very high magnifications, when a fine transverse striation is apparent.

Head-papillae very small, four submedian papillae present, lateral papillae not noted.

Esophagus simple, *i. e.* not divided into anterior and posterior regions, and short.

Male 48–56 mm. long, with a maximum thickness of about 0.45 mm. Esophagus 1.2–1.4 mm. in length.

The posterior end of the body is coiled in a loose spiral and provided with cuticular alae at its extremity. Cloaca 0.07 mm. from the posterior extremity. There seem to be nine pairs of papillae, of which four are preanal and five postanal. The papillae

of the last pair are small and flat; they no doubt correspond to the similar pair at the posterior extremity of the female. The eight anterior pairs of papillæ are elongated and decrease in size from before backwards.

The two spicules are very unequal, measuring 0.38-0.42 mm. and 0.13-0.14 mm. respectively. The long spicule consists of an anterior tubular region followed by a partly membranous posterior region. The small spicule is conical and terminates in a point.

Female 160-175 mm. in length, with a maximum thickness of about 0.7 mm. The œsophagus measures 1.5-1.7 mm. in length.

Anus about 0.15 mm. from the posterior extremity, the latter rounded and provided with a pair of small flat papillæ. At the level of the anus the body has a thickness of 0.2 mm.

Vulva 1.9-2.4 mm. from the anterior extremity. The slender vagina has a forwardly directed loop which extends to the level of the nerve-ring, 0.4 mm. from the oral end.

Ovoviparous. Eggs thin-shelled, measuring 0.022 mm. \times 0.015 mm.

Genus ACANTHOCEILONEMA Cobbold, 1870.

ACANTHOCEILONEMA DIACANTHA (Molin, 1858).

Filaria diacantha was originally described from worms obtained in the abdominal cavity and lungs of various Rodents in Brazil. The specimens from the Society's Gardens are from the Canadian Porcupine, *Erethizon dorsatum*, and were found in the peritoneal cavities.

The original description is somewhat incomplete, and Hall, in his monograph of the Nematode parasites of Rodents (1916), is inclined to regard this form as a species of *Setaria*; the well preserved material before me makes it, however, quite clear that the worm is to be referred to Cobbold's genus *Acanthocheilonema* as recently redefined by Railliet, Henry, and Langeron (1912).

Specific diagnosis.—*Acanthocheilonema*: Body slender, filiform, diminishing in breadth at both extremities and much attenuated posteriorly. Anterior extremity somewhat claviform, the head being separated from the rest of the body by a slight, neck-like constriction.

The cuticle appears longitudinally lined under a low power of the microscope; high magnifications, however, reveal a very fine transverse striation.

Six head-papillæ are present, four submedian and two lateral. The lateral papillæ are large and project in such a way that the head appears almost square in dorsal or ventral view.

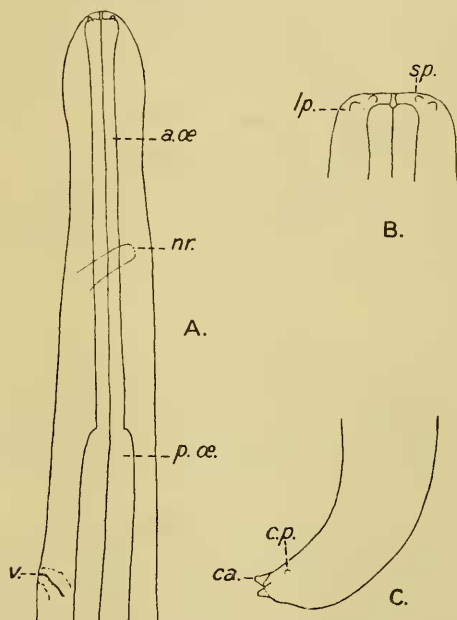
The œsophagus consists of distinct anterior and posterior regions; the former is narrow and measures under 0.5 mm., the posterior region is stouter and has a length of 2.3 mm. The nerve-ring surrounds the middle of the anterior part of the œsophagus.

The caudal region is long and slender, and its extremity in both sexes is provided with a pair of conical appendages; in front of these on the ventral surface is a pair of small flat papillae.

Male 35-40 mm. long, its greatest breadth about 0.25 mm. The head has a breadth of only 0.07 mm.

The posterior end of the body is coiled in a loose spiral. Cloacal aperture 0.25-0.28 mm. from the extremity. *Male*

Text-figure 3.



Acanthocheilonema diacantha (Molin).

A. Lateral view of anterior extremity of female. $\times 120$. B. Dorsal view of head. $\times 225$. C. Tail of female, lateral view. $\times 225$.

a. œ., anterior region of oesophagus; *ca.*, caudal appendage; *cp.*, caudal papilla; *lp.*, lateral head-papilla; *nr.*, nerve-ring; *p. œ.*, posterior region of oesophagus; *sp.*, submedian head-papilla; *v.*, vulva.

papillae small, consisting of five pairs, four preanal and one post-anal close behind the cloaca.

The unequal spicules measure 0.14 and 0.11 mm. in length respectively; the longer spicule is tubular in shape, with a somewhat ill-defined membranous posterior region, the smaller spicule is in the form of a strong tube, bent in the middle.

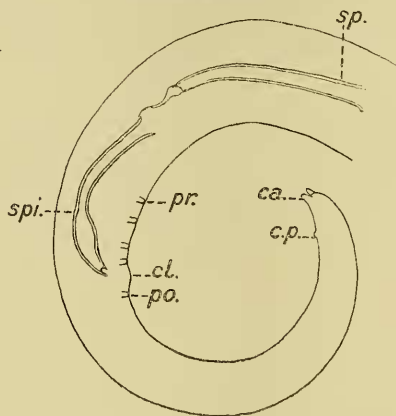
Female 58-65 mm. in length, with a maximum breadth of about 0.35 mm. Head 0.08 mm broad.

Anus about 0.2 mm. from the posterior extremity.

Vulva 0.65–0.9 mm. from the anterior end. The long vagina runs almost straight backwards.

Ovoviparous. Eggs thin-shelled, measuring 0.03×0.02 mm.

Text-figure 4.



Acanthocheilonema diacantha (Molin).

Posterior extremity of male, lateral view. $\times 225$.

ca., caudal appendage; *cl.*, cloaca; *c.p.*, caudal papilla; *po.*, post-anal papilla; *pr.*, preanal papilla; *sp.*, long spicule; *spi.*, short spicule.

ACANTHOCHEILONEMA GRACILE (Rudolphi, 1819).

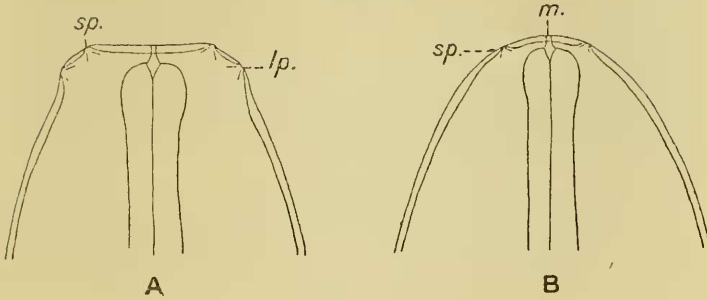
Filaria gracilis is a common parasite of Monkeys and has been listed from more than twenty-five species, including both Old-World and New-World forms. My material is derived from the peritoneal cavities of the following species, all from the Society's Gardens: White-fronted Capuchin (*Cebus hypoleucus*), Smoky Woolly Monkey (*Lagothrix infumata*), Moustache Marmoset (*Leontocebus mystax*), and Squirrel Monkey (*Saimiris sciurea*).

The systematic position of this worm is somewhat uncertain. Diesing, in his famous 'Revision der Nematoden' (1860), placed it in his genus *Dipetalonema*, a genus which is not only ill-defined, but contains also widely separate forms from Birds and Reptiles. In many of its characters, *e.g.*, position in the host, structure of head-papillæ, œsophagus, caudal appendages, spicules, etc., *Filaria gracilis* closely resembles certain species of *Acanthocheilonema*, and I have decided to include it, at least provisionally, in this genus.

Specific diagnosis.—*Acanthocheilonema*: Body filiform, very elongated, much diminished in breadth posteriorly. Head narrow, not separated from the body by a neck-like constriction.

Cuticle with very fine transverse striations, only visible under high magnifications.

Text-figure 5.

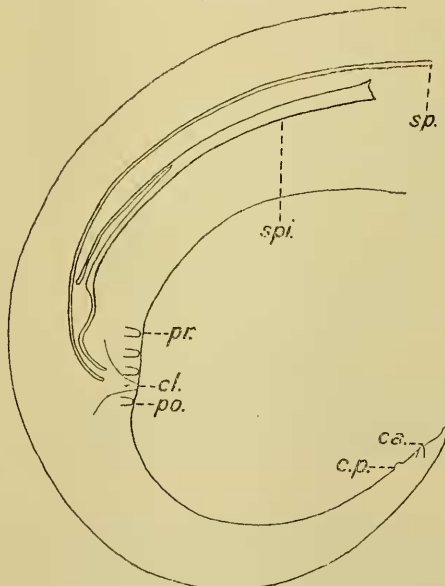


Acanthocheilonema gracile (Rud.).

Head: A. Dorsal view, B. Lateral view. $\times 225$.

l.p., lateral head-papilla; m., mouth; s.p., submedian head-papilla:

Text-figure 6.



Acanthocheilonema gracile (Rud.).

Posterior extremity of male, lateral view. $\times 225$.

c.a., caudal appendage; c.p., caudal papilla; cl., cloaca; po., postanal papilla; pr., preanal papilla; sp., posterior part of long spicule; spi., short spicule.

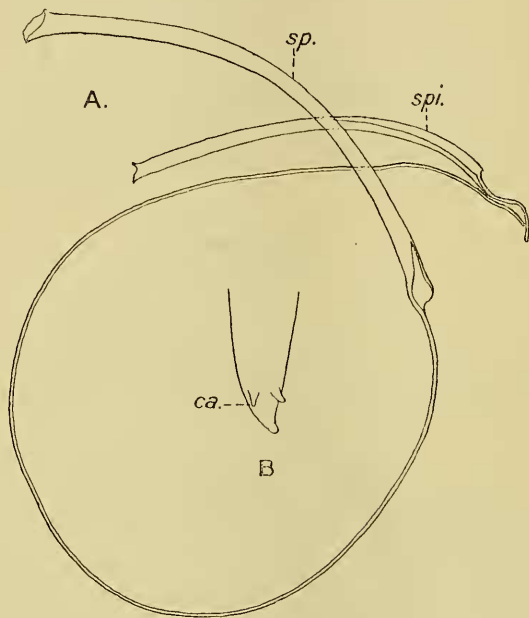
Six head-papillæ, the lateral pair prominent giving the head a truncated appearance when viewed from the dorsal or ventral surface.

Esophagus consisting of unequal anterior and posterior regions.

Caudal region long and very slender, in both sexes provided with a pair of conical appendages.

Male 96-110 mm. in length, with a maximum thickness of about 0.27 mm. Head 0.09 mm broad.

Text-figure 7.



Acanthocheilonema gracile (Rud.).

A. Spicules of male. $\times 225$. B. Caudal extremity of female. $\times 225$.

ca., caudal appendage; sp., long spicule; spi., short spicule.

The posterior end of the body is very slender and coiled in a loose spiral. Cloaca 0.26-0.28 mm. from the extremity. Three or four pairs of preanal papillæ and one pair of postanal papillæ close to the cloaca. A pair of small conical appendages are situated 0.02 mm. from the posterior extremity; just anterior to them are a pair of small flat papillæ.

Spicules very unequal; the long spicule is 1.23 mm. long, and consists of an anterior tubular region, 0.33-0.36 mm. in length, followed by a long thin terminal region; the short spicule

measures 0.27 mm., it also has the shape of a tube, terminating in a membranous, hooked extremity.

Female 160–250 mm. long, with a greatest thickness of about 0.38 mm. Head 0.11 mm. broad.

The anterior region of the oesophagus measures 0.58 mm., the posterior 2.5 mm. in length.

Caudal region with a pair of elongated appendages, about 0.03 mm. from the end of the body. Anus 0.63 mm. from the extremity.

Vulva 0.8–1.15 mm. from the oral end. The long, straight vagina is directed posteriorly and has a length of 8 mm.

Ovoviparous. Eggs small and thin-shelled, measuring 0.015–0.018 \times 0.01 mm.

Genus DICHEILONEMA Diesing, 1860.

DICHEILONEMA HORRIDUM (Diesing, 1851).

Examples of this well-known species were sent to me from the Prosectorium on two occasions; they were obtained from the body-cavity of *Rhea americana*. It is a worm commonly reported from Zoological Gardens.

Genus DIPLOTRIENA Railliet et Henry, 1909.

The genus *Diplotriena* was established by Henry (in Henry and Ozoux, 1909) to include a group of very closely allied species of *Filaria* from the body-cavities of various birds, chiefly Passeriformes. They are easily recognised by the presence of a peculiar apparatus in the form of a pair of chitinous "tridents" situated in the front of the head, and by the structure of the male spicules, one of which is straight, the other twisted.

Fifteen species have been referred to this genus; the majority have, however, been so imperfectly described that their recognition is very difficult. The material from the Society's Gardens includes three species which are to be placed in this genus; two of these I have referred to established species, the third is described as new. Diagnoses of the species of *Diplotriena* must be regarded as merely provisional until a thorough revision of all known forms has been made.

DIPLOTRIENA TRICUSPIS (Fedtsch., 1883).

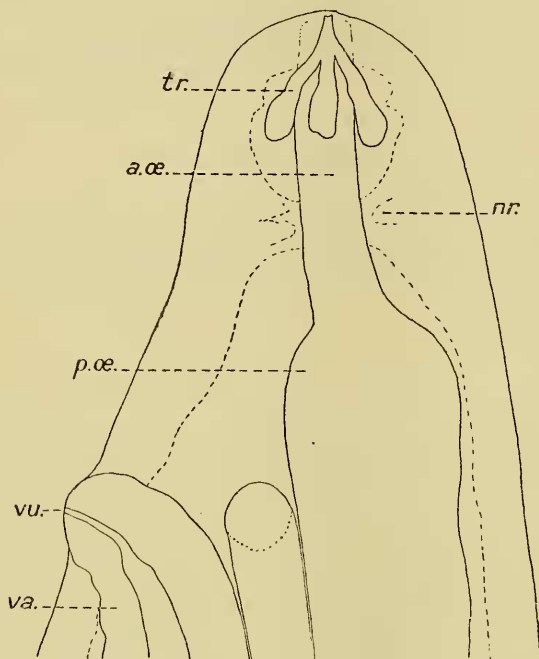
Stossich's monograph of Filariids (1897) shows that *Filaria tricuspis* has been recorded from a large number of different Birds; the measurements given in his specific diagnosis make it clear, however, that a number of species have been confused under this name.

The specimens which I have referred to *D. tricuspis* were found in the body-cavities of the White Headed Starling,

Poliopsar leucocephalus; in their measurements they agree fairly well with the worms described by v. Linstow (1891) as belonging to this species. My material consisted of females only.

Specific diagnosis.—*Diplotriæna*: Body long, filiform, tapering close to the anterior and posterior extremities which are of approximately the same thickness. Cuticle not transversely ringed.

Text-figure 8.



Diplotriæna tricuspis (Fedtsch.).

Lateral view of anterior extremity of female. $\times 120$.

a.æ., anterior region of œsophagus; *nr.*, nerve-ring; *p.æ.*, posterior region of œsophagus; *tr.*, trident; *va.*, vagina; *vu.*, vulva.

Six head-papillæ; the four submedian are very small and inconspicuous. The œsophageal trident has a length of 0.15 mm.; its anterior stem is truncated.

Œsophagus consisting of a short anterior region and a very long posterior region. The nerve-ring surrounds the anterior œsophagus about 0.25 mm. from the anterior extremity.

Female 160–180 mm. long; the greatest breadth of the body is about 0.6 mm.

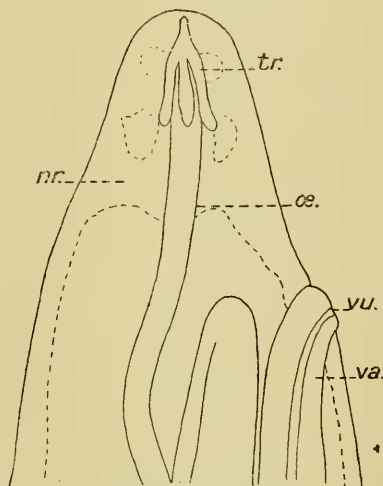
The narrow anterior region of the œsophagus has a length of

0.35 mm., the wider posterior region 8.8 mm. The anus is sub-terminal.

Vulva 0.55–0.6 mm. from the oral extremity. The stout, muscular vagina runs straight backwards, and has a length of 25 mm.

Oviparous. Eggs thick-shelled, $0.045\text{--}0.05 \times 0.035$ mm., containing well-developed embryos.

Text-figure 9.



Diplotriena diuceae, sp. n.

Lateral view of anterior extremity of female. $\times 120$.

Lettering as in the preceding text-figure.

DIPLOTRIENA DIUCEAE, sp. n.

This worm was obtained from the body-cavity of the Diuca Finch, *Diuca grisea*; the material included both male and female specimens.

Specific diagnosis.—*Diplotriena*: Body comparatively short, semi-transparent, tapering at both ends. The anterior extremity is narrower than the posterior.

Cuticle thin, transversely ringed.

Cephalic extremity with six very inconspicuous, flattened papillae.

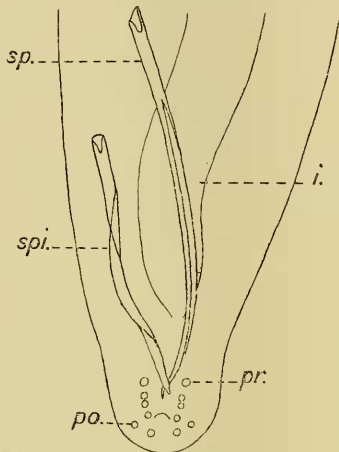
Each cesophageal trident has a length of 0.13–0.14 mm.; its anterior stem terminates in a fine point. Cesophagus 2.5–4 mm. long, narrow throughout, and without division into anterior and posterior regions. The nerve-ring surrounds the cesophagus 0.2 mm. from the anterior extremity.

Male 12-20.5 mm. long, with a maximum breadth of about 0.75 mm.

Cloaca 0.06-0.07 mm. from the posterior extremity. Tail broad and rounded. There are six pairs of inconspicuous, flattened papillæ; four pairs are preanal, two postanal.

Spicules unequal; the long spicule is straight and has a length of 0.72 mm., the short spicule is twisted and measures 0.45 mm.

Text-figure 10.



Diplotriena dinca, sp. n.

Posterior extremity of male, ventral view. $\times 75$.

i., intestine; *po.*, postanal papilla; *pr.*, preanal papilla; *sp.*, long spicule;
spi., short spicule.

Female 30-43 mm. in length; the body attains a thickness of 0.9 mm.

Anus about 0.1 mm. from the rounded extremity. The vulva projects slightly from the ventral surface, 0.35 mm. from the cephalic end. Vagina short, 0.9-1 mm. in length.

Oviparous. Eggs thick-shelled, measuring 0.045-0.05 \times 0.03 mm.

DIPLOTRIENA FLABELLATA (v. Linstow, 1888).

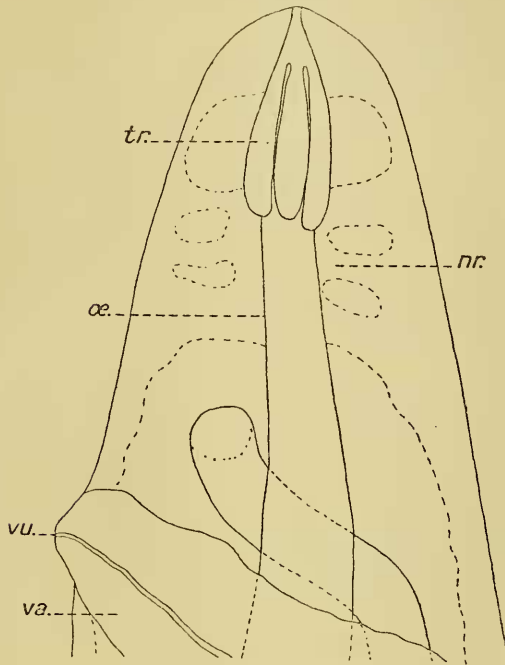
My material includes a single specimen of a female *Diplotriena* from the body-cavity of the Red Bird of Paradise, *Paradisea rubra*. I take it to be the same species as *D. flabellata* described from *Paradisea apoda* by v. Linstow in the 'Challenger' Reports (1888).

Specific diagnosis.—*Diplotriena*: Body short, more attenuated anteriorly than posteriorly.

Cuticle transversely ringed. Oesophagus not divided into two regions, narrow anteriorly, increasing in width gradually behind the nerve-ring, the latter 0.3 mm. from the oral end.

Trident 0.25 mm. long, its anterior stem truncated.

Text-figure 11.



Diplotriena flabellata (v. Linst.).

Lateral view of anterior extremity of female. $\times 120$.

Lettering as in the preceding text-figures.

Female 44 mm. in length, with a maximum thickness of about 1 mm. Caudal extremity rounded, broader than the head. Position of anus not ascertained.

Vulva prominent, 0.6 mm. from the anterior extremity; the thick muscular vagina has a length of 2 mm.

Oviparous. Eggs thick-shelled, 0.04–0.045 mm. \times 0.25 mm.

INCERTE SEDIS.

FILARIA ARAMIDIS, sp. n.

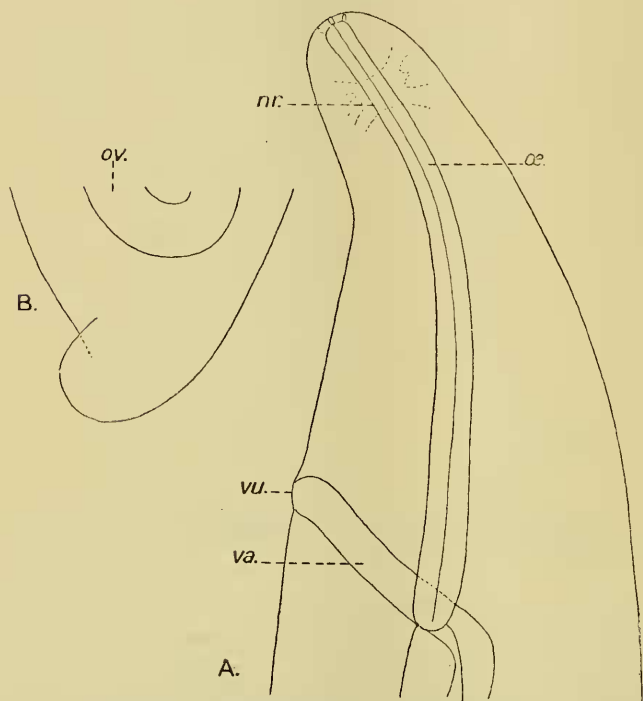
A single specimen of this species was obtained from the leg-muscles of the Cayenne Rail, *Aramides cayennensis*. In the absence of the male it is impossible to place the form in its

proper systematic position; I have, therefore, retained it in the genus *Filaria* s.l. In some respects it appears allied to certain species known from the muscular system of Mammals, e.g. *Filaria scapiceps* Leidy (Hall, 1916).

Specific diagnosis.—*Filaria* s.l.: Body comparatively short and thick, tapering nearly equally at both extremities.

Cuticle finely striated transversely.

Text-figure 12.



Filaria aramidis, sp. n.

A. Anterior extremity; B. Posterior extremity. Lateral view. $\times 75$.

Lettering as in the preceding text-figures. *ov.*, loop of ovary.

Head rounded, bearing four very small submedian papillæ; lateral papillæ not seen.

Oesophagus narrow and simple, *i.e.*, not divided into anterior and posterior regions. Nerve-ring close to the anterior extremity.

Female 25 mm. in length, with a maximum breadth of about 1 mm. Width of head 0.2 mm. The oesophagus has a length of 1.1 mm. Posterior extremity rounded; position of anus uncertain, about 0.15 mm. from the end of the body.

Vulva 0.82 mm. from the anterior extremity; the slender vagina is directed posteriorly and has a length of 2.4 mm.

Eggs thin-shelled, measuring $0.03-0.035 \times 0.02$ mm.

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